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MILITARY SCIENCE

Defense Against Planes Shows Great Improvement

Defense from the ground against attack from the air, recognized ever since the world war as one of the most difficult of all military problems, has made great strides forward during recent months. New weapons and fire control instruments developed by the Ordnance Corps of the Army and now undergoing tests at the proving grounds at Aberdeen, Md., go far toward taking the soldier on foot out of the class of a mere helpless target for bombs and "strafing" machine gun fire from planes, to which he has been assigned by popular conceptions.

The most striking of the new means of defense is not in itself a new weapon, but a means of making more effective use of already existing weapons. This is the new electrical fire-control instrument for anti-aircraft guns, which enables the commander of a battery to sight all four of his guns simultaneously, and also to set the fuzes for all the shells. These important details have hitherto been attended to separately for each gun, with the result that errors both in direction of fire and in position of the shell at the moment of burst have crept in, seriously lowering the effectiveness of the fire. The new system makes it

possible for a battery of four 3-inch guns to deliver a 15-pound shell every half-second, to a height of 10,000 yards, with a horizontal range of 15,000 yards. The same control system has been applied to the new 105-millimeter, or 4.1-inch guns, which fire only half as fast, but throw a shell more than twice as heavy to a height of 12,000 yards and an extreme horizontal range of 19,000 yards.

These two weapons commonly use shrapnel, which it timed to burst short of the target and throw toward it a shower of hardened lead alloy balls, shot-gun fashion. A smaller-caliber gun, however, is designed to attack planes with high-explosive shell that bursts on contact with even so slight an obstacle as the fabric of wing or fuselage. This is the 37-millimeter automatic, which throws a missile weighing about one pound. The piece is built like a machine-gun and barks once every second, so that a battery of four would send up a hail of 240 highly destructive shells in a minute. The new centralized fire control system can be applied to this gun as well, though this has not yet been done.

A third promising weapon is the new .50-caliber Browning machine

gun, which throws a cigar-shaped bullet half an inch in diameter and weighing about two ounces. A newly developed mount permits four of these guns to be trained on a single pivot. Since each gun can deliver over 300 shots per minute, this arrangement places a stream of 20 missiles per second under the control of one gunner.

Ordnance officers do not expect to drive planes completely from the air, even with the further improvements still in prospect. Part of the anti-aircraft defense will still have to be undertaken by planes attached to the defense forces, just as the protection of our coasts is a joint task for the coast defense artillery and the fleet. But just as the coast defense artillery is usually able, by the mere threat of its presence, to keep an enemy fleet at a long distance, so the anti-aircraft weapons are expected to force enemy planes and dirigibles to fly at such heights that their bomb-dropping, observing, photographing and other activities will be relatively ineffective. Even the despised "archies" of war time, it is pointed out, forced German airmen to fly high, and there is simply no comparison between their range and accuracy and that of the anti-aircraft weapons of today.

(Just turn the page)



Anti-aircraft battery of 3-inch guns firing on target towed by airplane at the Aberdeen proving grounds. The new multiple fire control instrument is the center of an interested cluster of soldiers to the rear of the guns. Vertical range finder in the foreground.

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Defense Shows Improvement

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The soldier on foot is being given improved weapons against his entrenched enemies on the ground as well as against those that fly in the air. One of the most interesting of the smaller guns now undergoing tests at the proving ground is a three-inch mortar designed to be carried by the infantry as they go forward.

This piece throws the standard 12-pound artillery projectile to a range of 1740 yards. Though this is a short distance, as artillery ranges now go, it is quite adequate to be of great assistance in overcoming machine gun nests, breaking up "strong points," and resisting the advance of tanks. Since it is rifled, it is much more accurate than the loose-fitting smoothbore Stokes mortar of wartime fame. Its speed of fire is not so great as that of the Stokes, but it has better hitting power, and its range is of course considerably greater.

An interesting use of this gun, as well as of the Stokes mortar, is the blinding of machine gun nests and other enemy positions by dropping smoke shells on them. If they can not see to fire the attacking infantry will be able to advance with fewer casualties.

The mortar is so designed as to be readily disassembled into loads which can be transported by hand.

Science News-Letter, October 15, 1927

The dodo, a strange looking pigeon on the Island of Mauritius, became extinct in the seventeenth century.

Cod fishing and sheep raising are being developed in Greenland to help the 15,000 inhabitants to make a living.

A medical journal in 1869 said: "Out of every five children in the United States, three die before reaching the fifth year!"

News-Letter Features

Born over five years ago of the demand and interest of those individuals who had caught a glimpse of *Science Service's* news reports to newspapers, the SCIENCE NEWS-Letter has since proved interesting to laymen, scientists, students, teachers and children.

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X-Rays Speed Up Evolution Over 1,000 Per Cent.

By FRANK THONE

Evolution, eugenics, the breeding of new varieties of crop plants and domestic animals: these three phases of science, vitally near to the interests and welfare of all of us, are now under the spell of a new magic. It is a magic that bodes both good and ill, for while it holds out the prospects of producing new forms of life a hundred times faster than has hitherto been possible by the best methods known so far, it also carries a warning that calls for severe caution in certain medical procedures that have become quite common in our modern world.

The wand of the new magic is not itself strictly new. It is our familiar friend the X-ray. The X-ray has been known for thirty years or some such matter, and what has been known for a generation is old stuff, in this day of mile-a-minute progress in science.

But the X-ray has found a new application—it is the new way of waving the old wand that has made the new magic. The new magic is as new as the newest front-page murder sensation or airplane record. It is only a short time since a quiet, soft-spoken professor from the University of Texas, Dr. H. J. Muller, stood up before a distinguished audience at the International Genetics Congress at Berlin, and in the most unsensational language imaginable broke the news of one of the most sensational researches ever conducted in the whole wide field of biology. It is hard to create a sensation in a scientific meeting nowadays, for professors have become too much accustomed to miracles of late; but Prof. Muller's address has been followed by a buzz of excited discussion that will be many months in dying out.

A Revolution in Evolution

Stated in three bald sentences, this is what Prof. Muller's experiments signify: Evolutionary changes, or mutations, can be produced 150 times as fast by the use of X-rays as they can by the ordinary processes of nature. This means that man can force the production of new and desirable plant and animal varieties far more rapidly than he has hitherto been able to get them. But X-rays affect the human hereditary cells too, and the reckless exposure of these cells to long and heavy doses of the rays is apt to inflict

fearful penalties on our unborn grandchildren.

The full import of each of these three statements might well require a good-sized book for its explanation—and doubtless will fill more than one book in due time. But the gist of the business, the key to the whole situation, can be set forth very briefly and simply.

Mutations and What They Mean

It all ties up with what the modern scientific breeder calls "mutations," which are the same things that the old-fashioned gardener called "sports." Mutations are what you get when a single-flowered plant suddenly produces offspring with double flowers, or when oranges that have always had seeds bring forth seedless progeny. Many of our choicest domestic plants and animals have originated in this way. The late Luther Burbank's reputation was built largely on mutations. He would plant millions of seeds and trust to luck to produce mutations, which his unfailing eye could pick out in a fraction of a second when he saw them in the field. Then he saved the mutations he wanted and wiped out everything else. With certain improvements and modernizations, Burbank's method is the one followed by all breeders.

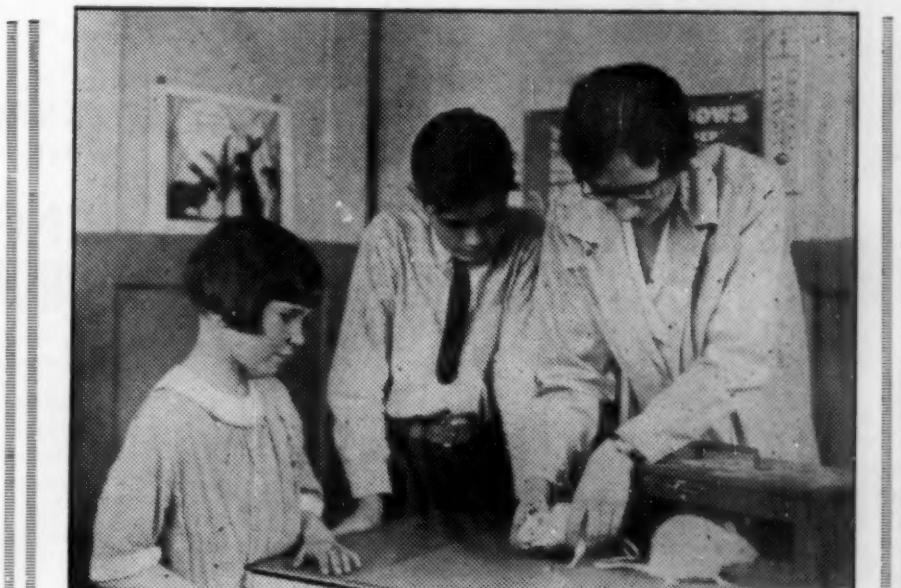
What the breeders do in field and pen, nature does on a grander scale, both as to space and time, in the process of evolution. Mutations arise

among animals and plants in the wild as well as among their domesticated kindred. The common double golden glow, for instance, is such a wild mutant; it just came of its own accord, without any invitation from a gardener. Later on some one saw it growing in the field and dug it up to take home. And nature acts the part of a super-Burbank in looking over these wild mutants and weeding out the undesirable ones with the drastic hoe of the struggle for existence, as Charles Darwin pointed out long ago. But though drastic, this weeding-out process is very slow, and that is why natural evolution is so much more deliberate a process than the hurry-up selection and destruction practised by the breeder.

Natural Mutation Too Slow

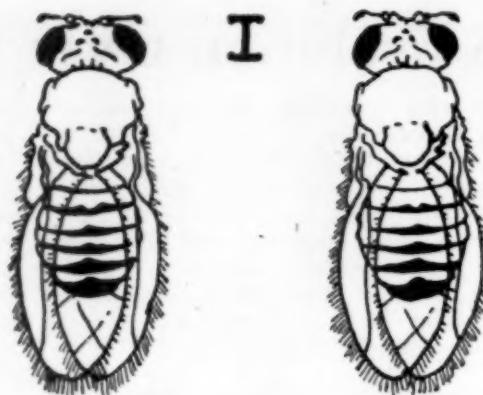
While man can select the new forms he wants to keep much more rapidly than nature can, he has hitherto enjoyed no such advantage in the rate at which he can get new forms from which to do his selecting. In the long run, mutations in the garden or pasture do not occur any oftener than mutations in the forest. But man is an impatient creature, and does not like to sit down and wait for something to happen, on which he can then go to work. He wants to *make* something happen. He wants what he wants when he wants it—and that includes

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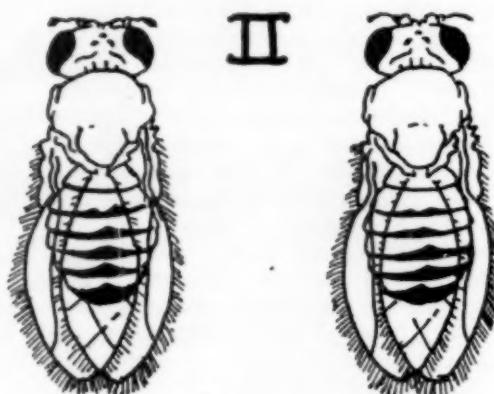
EXPERIMENTS ON RATS AND MICE will eventually tell much of what the new discoveries may be expected to mean to future generations of children

PARENT
GENERATION
—NORMAL
INSECTS



EXPOSED TO
X-RAYS AND
THEN BRED

FIRST
GENERATION
OFFSPRING



APPARENTLY
NORMAL BUT
CARRYING
CONCEALED
MUTATIONS



NORMAL



MINIATURE
WING



RUDIMENTARY
WING



WHITE
EYE

SECOND GENERATION OFFSPRING. MANY STILL
NORMAL, BUT WITH NUMEROUS "FREAK" BROTHERS & SISTERS

WHAT X-RAYS DO TO GRANDCHILDREN: a simplified family tree of Professor Muller's experimental insects showing in diagrammatic form how the "curse" is handed down

X-Rays Speed Evolution

(Continued from page 243)

mutations. Assisting or forcing nature in some way, so that new things will be produced faster than at the old, poky rate, has for centuries been the breeders' dream.

The Mechanism of Mutations

Until recently, however, there was not even a hint of hope that this

dream might be realized, because nobody knew what made mutations happen. Nobody knew their mechanism. And until that was known, man lacked a handle to take hold of in his effort to push nature along a bit.

Then, about a generation ago, a few years after the discovery of X-rays, biologists made a re-discovery of the lost work of Gregor Men-

del, and the science of genetics suddenly came of age. Men with microscopes looked critically at all kinds of reproductive cells, to see whether they could learn what carried from parent to offspring the "unit characters" of heredity, such as red in hair or blue in flowers, and they saw some very curious things. Not only in the dividing

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X-Rays Speed Evolution

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reproductive cells but within every living cell that divided, there were numbers of special, dense bits of the living substance, that looked rather like microscopic sausages of assorted sizes and shapes. Because these special bits of protoplasm stained especially deeply with the dyes used to color the cells in preparation for the microscope, they called them "chromosomes," which is simply Greek for "color bodies."

Chromosomes and Genes

If chromosomes were to be named over again, modern biologists would probably call them "genophores," or "gene-bearers," because they think of them as the things in which, or on which, roost and ride the genes, or chemico-physical carriers of hereditary qualities. Nobody ever saw a gene, and probably nobody ever will, for they are conceived of as being too small to be visible under even the highest powers of the microscope. Indeed, even the chromosomes are so small that it takes a very powerful instrument to see them, and the genes they carry are ever so much smaller than that. Scores, probably hundreds, of genes ride on each chromosome.

But if the genes are so small, and no one has ever seen them, how do we know that they exist? Some scientific skeptics maintain that they don't, but perhaps a majority of geneticists, who are the special students of this subject, believe that they do. They declare that every time a mutation occurs, like the production of a wingless insect from a winged parent stock, a certain particular bit of a given chromosome shows up missing, or at least is in an unaccustomed place, when they look at it through their lenses. Every time there is a mutation, they say, they can show a chromosome that has had an accident. This parallelism between mutations and chromosomes gone wrong has been traced in hundreds, even thousands, of cases. The defenders of the gene have plenty of data to back up their case.

Arranging Accidents

If mutations always follow when accidents happen to the chromosomes in the course of nature, why not arrange a few such accidents, and thus get your desired hastening of the mutation process? Chromosomes are a bit hard to get at, and

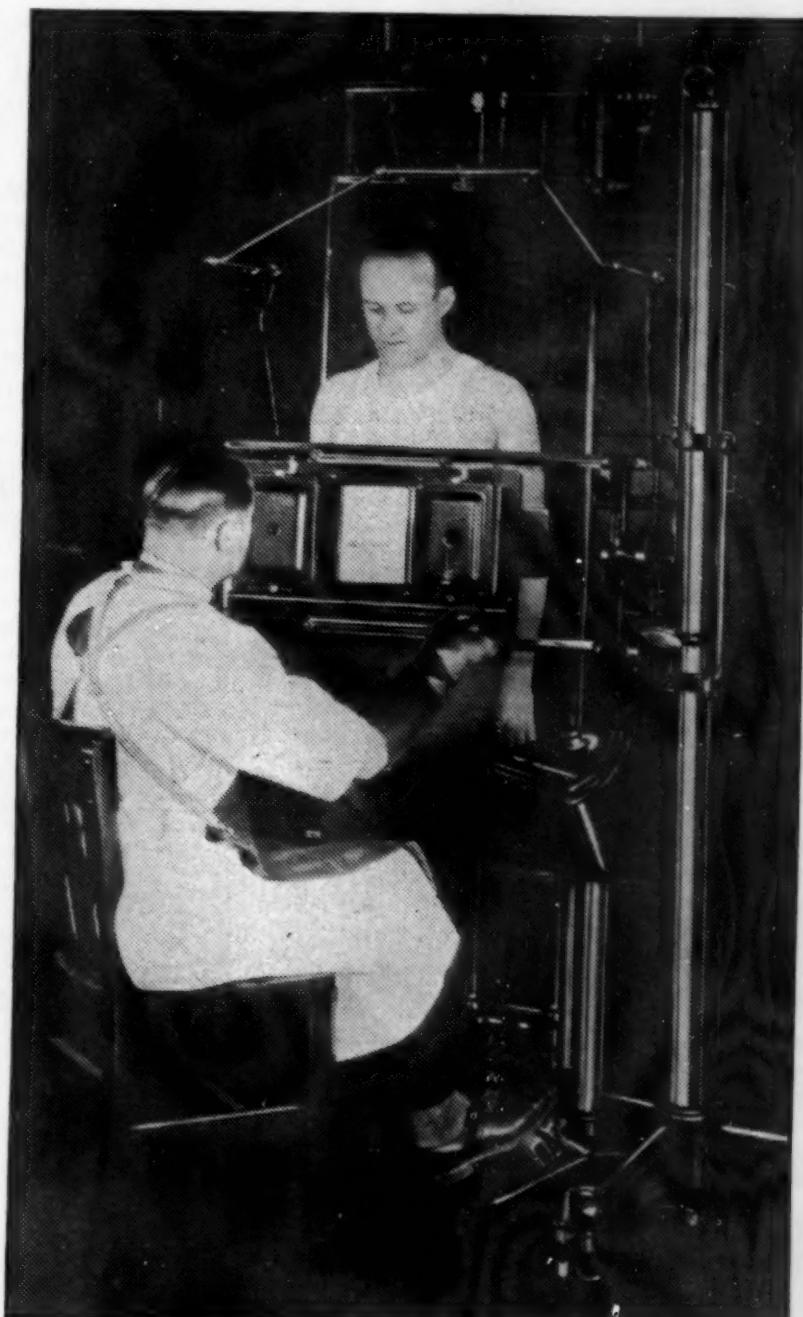
seem to be stubborn things anyway. Several means were attempted: ultraviolet rays, serum treatments, mechanical whirling, extremely rapid sound waves, even light doses of X-rays, but the results were all either negative or somewhat equivocal. Prof. Muller decided, in spite of the unpromising reports of other workers, to make one more try at it. He would use heavier doses of X-rays.

The Handy Fruit Fly

It didn't really matter much what animal or plant he used. It was cells he was interested in, and though

living things differ vastly in size and shape, the cells out of which we are made are so much alike that in many fundamental things what holds true for a toadstool is true for an oak, and what can be done to a tiny insect can be done to a horse or a man. So Prof. Muller chose the little flying creature we find on fruit when it begins to spoil, known variously as fruit-fly, vinegar-fly and pomace-fly. It has the advantage that it breeds very rapidly—maturing in twenty-one days, as against twenty-one years in man. Furthermore, it

(Just turn the page)



X-RAY EXAMINATIONS AND TREATMENTS ARE NOT DANGEROUS under normal conditions; only when the hereditary cells are exposed to heavy raying do we take chances with the welfare of our grandchildren

X-Rays Speed Evolution

(Continued from page 245)

is cheap to maintain, demanding only a pint milk bottle as its cage and a bit of blotter soaked in banana juice for its whole rations. Finally, it has been studied intensively, and its mutations are probably better known than those of any other living thing.

The faintly buzzing little creatures were exposed to heavy doses of X-rays, and then allowed to breed. Presently the new generation hatched from their eggs. They were less numerous than might have been expected, but otherwise apparently all right. But that did not fool the researcher. There are such things as "recessive" characters, which appear not in the children but in the grandchildren; most mutations, indeed, are of this recessive nature. So Prof. Muller bred the first generation offspring and got a second.

Results of the Raying

Here he began to see results aplenty. Mutations such as he had often seen in un-X-rayed stock turned up, together with a number of brand new ones. All told, he figures that he has produced at least 100 distinct gene mutations, and that the raying has speeded up the process over 1,500 per cent. Some of the insects turn up with wings only half size, others with no wings at all, still others with wings of normal length but abnormally wide, or notched at the end, or splotched with odd patterns. Instead of their normal dark eyes, some of the little flies have white ones. Many of the new mutations must have been natural impossibilities, for the flies never hatched at all. Such mutations are known as "lethals," and their existence can be detected only by counting the offspring of normal, unrayed insects and comparing numbers. Male and female insects respond alike to the raying.

What It All Means

The obvious thing to do next is

to try similar treatments on the larger, slower-breeding animals and on plants, with an eye to turning to agricultural advantage the numerous mutations this speeding-up process may be expected to produce. Prof. Muller says that this will be done "eventually." Further work on his fruit flies will probably come first, then experiments with rats and mice, which are cheap and can be wasted without regrets. But in the end, in an "eventually" not too remote, the rays will be applied to sheep and cattle and wheat and apples. The simplest of arithmetic will show that if the mutation-producing process can be speeded up even a tenth as much with these larger organisms as it is with the little fruit-flies, the gain to plant and animal breeding will be enormous.

A Menace in Birth Control

The production of mutations by X-rays comes home to the human species even more intimately than in its effects on his crops and livestock. There are such things as human mutations. When they arise in the course of nature, a family may be blessed with a Lincoln or an Edison, or it may be sickened and saddened with a child born mentally or physically defective. Most of us would rather forego the chance of a genius to escape the chance of a cripple among our descendants. Obviously therefore, X-ray doses of high intensity and long duration are things to be shunned so far as they concern the physical basis of human heredity, and this point is especially stressed by Prof. Muller.

There is no danger in ordinary X-ray examinations anywhere on the body, nor in properly regulated therapeutic treatments that do not come too close to the generative system. But the danger zone is now clearly indicated, and the warning has been unmistakably sounded.

X-rays have been more or less re-

sorted to by persons desiring to limit the number of their children. The treatment results in temporary sterility, which afterward passes, permitting the production of offspring. But Prof. Muller's work indicates that while the first generation following such treatment may be apparently normal, they will carry concealed within them recessive mutations that may crop out as a horror and a curse to the third and fourth generations and to all succeeding posterity. As a means of birth control, therefore, X-rays are to be most severely shunned.

Science News-Letter, October 15, 1927

Mercury poison in the air, even so little as one part in 20,000,000 parts of the atmosphere, can be detected by a new device.

Weather records from all parts of the earth are gathered together in an important new publication by the Smithsonian Institution.

Bones of an ape which had been kept in a temple at Thebes about 2000 B. C. show that rickets was a malady of that ancient time.

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WHAT CHROMOSOMES LOOK LIKE: three figures from the dance of life every living cell performs when it divides to produce new cells

Say you saw it advertised in the SCIENCE NEWS-LETTER

AGRICULTURE

Borer Campaign A Success

"The corn borer campaign has been successful and has accomplished as far as is humanly possible the object set out to accomplish." This is the verdict given out by the executive committee of the international corn borer organization on the ten-million-dollar war on the corn pest undertaken last spring.

A census of the borer population by actual count has been made in approximately 750 townships in the heavily infested states, declares Dr. W. H. Larrimer, in charge of corn borer work at the U. S. Bureau of Entomology. Results of surveys in New York, Pennsylvania, Ohio and Michigan show that there is an average of 13 borers per 100 corn stalks in the campaign area as opposed to an average of 8 borers per 100 stalks last year. Though this means an increase of 50 per cent. for this year, it compares favorably, the entomologist pointed out, with the 300 per cent. gain made by the borers in 1926 when no general control measures were in operation. The increase came about this year in spite of a cleanup that destroyed 95 per cent. of the borers. For the pests' powers of reproduction, Dr. Larrimer explained, are such that five of an original population of 100 will produce an average of 150 more adult corn borer moths. This condition notwithstanding, the Department of Agriculture considers the campaign more effective than it had dared expect.

In the light of the fact that the corn borer feeds on some 225 plants with an expressed preference for a diet of corn stalks, eradication of the pest is considered impossible. Of twelve natural insect enemies of the corn borer imported into this country from Europe in the last six years with the hope of checking its spread, six have become established. While such means of biological control necessarily take years to become effective it is regarded as a very hopeful indication that half of the species of corn borer enemies introduced become permanent residents.

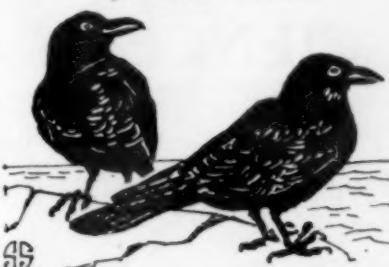
Of the ten million dollars appropriated to fight this foe of America's corn crop, no money has been used for quarantine or research purposes. The bulk of the appropriation has been spent on compensation to farmers for extra work, special machinery, field equipment and supplies and a far reaching educational program.

Science News-Letter, October 15, 1927

BIOLOGY

NATURE RAMBLINGS

By FRANK THONE



Fish Crow

The common crow of ill cornfield fame is a big, robust, hearty thief, who wins the grudging and oblique admiration most of us accord to a picaresque character. A rogue should be optimistic, or at least bold and cheerful.

But the common crow has a waterfront relative who lacks even this small grace. This is the fish crow, common along the Atlantic coast, and found straggling inland where large bodies of water yield odorous carrion for his sustenance. He never competes with the common crow; he is too small, too weak, too lacking in energy and push to stand up against his stouter cousin.

The fish crow seems to be always shabby. His feathers are never as bright and glossy as those of the ordinary crow, never so smooth and well preened. He seems to be always rusty, always rumpled.

He flies less than the regular crow does, and when he is in the air he flaps along languidly as though he were very, very tired. But mostly he likes to sit on the topmost branch of a tall tree during a thin, slow autumn rain, looking down on passing events, with about as much curiosity as a typhoid convalescent shows. He does not shout his opinions with the vehemence and *elan* of his bigger relative, but cocks his head sidewise and addresses to his mates a weak-voiced, semi-apologetic, interrogative "Caw???"

It must be very sad indeed to be a fish crow.

Science News-Letter, October 15, 1927

CHEMISTRY

Why Sheep Are Black

Quotation from "Brighter Biochemistry," published by the Biochemical Laboratory, Cambridge University.

Baa, baa, black sheep, why so dark your wool?
Of tyrosinase, Sir, our carcasses are full,
Tyrosine in blood-stream, enzyme grabs it quick,
Turns it into melanin, and that does the trick.

Science News-Letter, October 15, 1927

SOCIOLOGY

Successes Have Most Children

The squawks of alarm that go up from every eugenics congress over the falling birth rate of the intelligentsia have received a rude damper.

Armed with the 25th anniversary records of graduates of Harvard University and a copy of "Who's Who," Dr. Frederick Adams Woods, formerly professor of biology at Massachusetts Institute of Technology, has set out to establish in the forthcoming issue of the Journal of Heredity that there is a correlation between high achievement and big families. Big, that is, for these days.

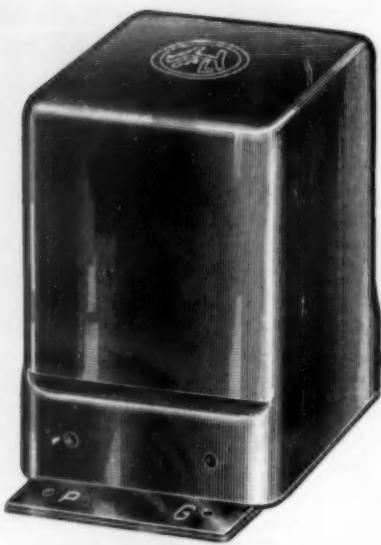
Dr. Woods picked classes that have been graduated 25 years because, he says, "Further distinction, unknown successes and failures may lie ahead, but not many will be the parents of any more children."

While "Who's Who in America" is no perfect test, he continues, of either mental superiority or what is commonly known as success, it is fairly probable that the classmates included in it would average more success than those not included.

Comparing these two sources of information, Dr. Woods found that 25.5 per cent. of the parents with four or more children in the class of 1894 were listed in "Who's Who" while the percentage of the unmarried so represented was only 6.3. In the class of 1898 all percentages were found to be lower due to the fact that the same issue of "Who's Who" was used in each case. Again the fathers of four plus showed the highest ratios and the bachelors the lowest. The highest ratios in the 1890 class were found for the parents of three, while this time the bachelors beat the parents with four or more offspring 15.1 to 14.3. The figures for the three classes added together, however, gave an almost smooth proportionate rise.

"I added the story from 1892," declares Dr. Woods, "and now, combining the four series of records, I feel practically sure that those who have the most children are the ones on the average who achieve the most success. Those who at some time in their lives marry but never have any offspring are about in the same standing as the parents, but the falling off for the unmarried is very marked. The figures run 9.7 for bachelors, 16.4 for married but childless, then 16.9, 16.8, 18.9 and 18.1 for one, two, three, four or more children respectively."

Science News-Letter, October 15, 1927



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ARCHAEOLOGY

War God Temple Discovered

By digging down into earth and sand where a few lonely columns near Thebes indicated an ancient ruin, French scientists have uncovered fragments of a remarkable Egyptian temple and have revealed the existence of a hitherto unknown Egyptian King.

Details of these excavations at Madamud, under the auspices of the French Institute of Oriental Archaeology, show that below the columns of a comparatively recent temple, of the Greco-Roman period, lie buried ruins of an older temple dating back to the twelfth dynasty, about 2200 B. C. From that time on to the Roman days the temple was dedicated to the war god Montou, who must have played a powerful role in the religion of this region. Statues of the war god and his companion goddess, Ra Tootui, have been found recently at the site.

In the course of digging, a sacred lake was discovered near the temple. Only five such lakes have previously been known, and great interest attaches to the discovery, since it is hoped that the bed of the lake can be searched for art treasures. It is believed that in times of grave danger, the priests would cast the most sacred temple possessions into these lakes to save them from vandals or political enemies.

Science News-Letter, October 15, 1927

EDUCATION

Art for Adults

Quotation from EDUCATION FOR ADULTS AND OTHER ESSAYS—Frederick Paul Keppel—Columbia University Press.

Then there is the question of the fine arts. We have the best opportunities in the world to hear music. More important architectural monuments are being erected here today than perhaps in all other countries combined. We are rapidly becoming the custodians, public and private, of much of the world's treasure in painting and sculpture. And yet it is only beginning to occur to us that one way for us as a people to get the solace and the delight which comes from an appreciation of beauty is to learn something about the different arts. I don't mean strings of names and dates to be memorized, but something very different. Here is a wonderful opportunity for an adult education that is re-creative. The current interest in the non-commercial drama touches alike recreation, the arts, the adult education, and is one of the most encouraging signs of the times.

Science News-Letter, October 15, 1927

GENETICS



HERMANN JOSEPH MULLER

Manipulator of Genes

Dr. Muller, whose work on the manipulation of genes by means of heavy doses of X-rays is discussed elsewhere in this issue of the SCIENCE NEWS-LETTER, is professor of zoology at the University of Texas. Although a Westerner by adoption, he is a New Yorker by birth and education. He was born on that most densely populated island in the world in 1890, and twenty years later received his bachelor's degree from the University of Columbia. The master's degree followed in 1911, at the same institution, and the doctorate in 1916.

His migration to Texas preceded the finishing of his graduate work. He first taught at Rice Institute, and at the time of the war was in charge of the department of biology there. There followed a two-year interim at Columbia, but in 1920 Dr. Muller returned to Texas, this time to his present position at Austin.

His interest in genetics dates back to his first graduate days, and he has worked almost wholly on the same material, *Drosophila*. He has devoted himself especially to the phenomena of crossing-over and to the study of mutation rates. He collaborated with his noted teacher, Thomas Hunt Morgan, in the production of "The Mechanism of Mendelian Heredity." This combination of interest in the behavior of chromosomes and in the statistical end of genetics has come to a natural climax in his present researches.

Science News-Letter, October 15, 1927

PSYCHOLOGY

Movies Bore Animals

Cats and dogs do not get much "kick" out of movies. During recent tests made by Dr. Victor Mendel, of Berlin, animals and birds showed a rather surprising lack of response to moving pictures. The pictures were especially selected for each animal and animal group, and the experiments were made in an exhibition room especially adapted to the purpose.

The response of dogs was practically nil. Neither St. Bernard, setter, spaniel, poodle nor collie gave the slightest attention to the pictures. Only a little mongrel of doubtful origin evinced a momentary interest by sniffing at the human figures on the screen. The experiments with cats were much more favorable. Of five subjects three responded actively, showing fight upon the appearance of a big dog on the screen.

Experiments with birds were rather negative. Geese and ducks, chickens and pigeons paid some attention, while owls showed great interest. Small birds and barnyard fowl showed anxiety when a hawk appeared in their line of vision. A squirrel displayed interest when a weasel made its appearance on the screen but reptiles and fish were, as might have been expected, quite indifferent.

Science News-Letter, October 15, 1927

ARCHAEOLOGY

Stone Artillery Ammunition

"Cannon-balls" of stone, dating back to a time before there were any cannon to propel them, have been excavated from the ruins of an ancient arsenal in the citadel of the old Greek city of Pergamon in Asia Minor. The exploration was conducted by a party of German scientists under the leadership of Dr. Theodor Wiegand, who has just reported his findings in Berlin.

Though these balls were never fired from cannon, they were artillery ammunition nevertheless. In the third century B. C., when they were carved, artillery consisted of huge crossbows or long wooden arms swung on counterweights, which could send stones and heavy darts whizzing through the air for considerable distances.

About 900 of these stone "cannon-balls" were found; they range in caliber between 5 and 16 inches, and in weight between 13 and 172 pounds.

Science News-Letter, October 15, 1927

If young diamondback terrapin are fed regularly and kept in a warm enclosure, they produce eggs a year earlier than similar terrapin that are allowed to hibernate.

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SCIENCE REMAKING THE WORLD

Edited by Otis W. Caldwell and Edwin E. Slosson.
New York: Doubleday, Page & Co. 1923.
\$2.50 and \$1.00.

KEEPING UP WITH SCIENCE

Edited by Edwin E. Slosson.

New York: Harcourt, Brace & Co. 1924.
\$2.50.

WHY THE WEATHER?

By C. F. Brooks.

New York: Harcourt, Brace & Company. 1924.
\$2.00.

SOIL AND CIVILIZATION

By Milton Whitney. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1925.
\$3.00.

CHEMISTRY IN MODERN LIFE

By Svante Arrhenius, translated and revised by
C. S. Leonard. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1925.
\$3.00.

DWELLERS OF THE SEA AND SHORE

By William Crowder.

Young People's Shelf of Science. Edited by E. E. Slosson.
New York: The Macmillan Co. 1923.
\$2.25.

Any book listed above—or any book in print—will be sent to any address on receipt of list price plus postage.

ANIMALS OF LAND AND SEA

By Austin Clark. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1925.
\$3.00.

THE EARTH AND THE STARS

By C. G. Abbot. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1925.
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MYSTERY OF MIND

By Leonard Troland. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1926.
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FOUNDATIONS OF THE UNIVERSE

By M. Luckiesh. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1925.
\$3.00.

CHEMISTRY IN THE WORLD'S WORK

By H. E. Howe. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1926.
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EVERYDAY MYSTERIES

By Charles Greeley Abbot.

Young People's Shelf of Science. Edited by E. E. Slosson.
New York: The Macmillan Co. 1923.
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STORIES IN STONE

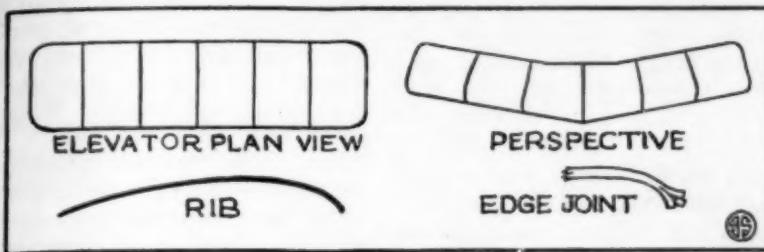
By Willis T. Lee. Library of Modern Sciences.
New York: D. Van Nostrand Co. 1926.
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SCIENCE SERVICE

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Building and Flying Model Airplanes



No. 13

This is the ninth of a series of articles by Paul Edward Garber, telling how to make model airplanes. Mr. Garber is in charge of aeronautics at the Smithsonian Institution.

Making The Elevator

The elevator frame is constructed entirely of bamboo. This wood should be split to approximate size, and then may be planed to exact dimensions. In the construction of other parts of the model we have used bamboo in short lengths, but for the elevator we will require longer pieces which will require careful handling to produce best results, therefore a few words on bamboo itself will be useful.

This useful wood has the properties of lightness and strength. It is a tropical wood, and is not generally sold at lumber yards but the model constructor will probably be able to obtain some either from a fishing pole, a rug pole, of which your local merchant no doubt has several, from a discarded piece of furniture containing bamboo rungs, or from a porch screen, as these are usually made with bamboo slats. Of course model airplane dealers sell it. It can easily be split, but you must be careful in doing so as it opens up rapidly when once started and you may cut yourself.

The best wood for our purpose is split off not by holding the knife across the diameter of the wood, but rather in the manner one would use to trim the bark from a tree. In this manner wide pieces of even texture can be obtained and these bend easier than those obtained by cutting diametrically. It will be observed that bamboo has humps or nodes every foot or so. These need not interfere in the procuring of a long straight piece, as they can be trimmed flat with a finely set plane.

To make the frame two pieces of bamboo $1/16$ inch square and 19 inches long are required. One is used for each edge of the outline. The bamboo can be easily bent to the desired shapes shown in the perspective drawing by holding the part to be curved above a flame and as

the part is heated it becomes pliable and can be shaped. Care must be taken not to burn the wood, and not to get the curve too much in one place as this may make a weak spot liable to break. The rear piece is formed with a flat section for three inches in the center, from which the ends are bent upward at a slight angle and curved at the tips, forming a "U" shape 14 inches long. The front edge has no flat section but bends upward from the middle at an angle slightly greater than that in the rear edge. It is similarly rounded at the tips. These two edges are now brought together with a lap joint at the ends, with the edges $3\frac{1}{2}$ inches apart. The lap joints should be about $\frac{1}{2}$ inch long and excess material beyond this point should be trimmed off. The intersection of each of the ends should be slightly recessed to reduce the size of the joint. The ends are fastened with Ambroid and bound with thread.

The ribs are next made. Five are required. To form them take a slat of bamboo $\frac{3}{8}$ inch wide, $1/16$ inch thick and $3\frac{1}{2}$ inches long. By holding this above a flame until it is hot it can be bent to the shape shown in the drawing. From this the five ribs are split, thus making them identical. If necessary the ribs may be made from $1/16$ inch square pieces bent separately but the former method is recommended as being easiest and best.

The ends of the ribs are split slightly and this part forked over the edges as shown in the detail drawing. They are retained in the places indicated in the drawing by the use of Ambroid. The elevator is covered on the upper surface only with a piece of Japanese tissue paper that was left from the wing job. It is covered in a similar manner to that used for the wing, namely, one section at a time is first painted with banana oil and then covered, using a piece of paper larger than

(Just turn the page)

Ectoplasm Called A Fraud

"Ectoplasm," one of the chief items in the stock-in-trade of present-day spiritism, is something as yet quite unproved scientifically, and all efforts to demonstrate it by really critical methods have ended by demonstrating something quite different: to-wit, fraud on the part of the medium or "psychic" who claimed to have the power of producing it.

Thus declares Dr. E. E. Fournier d'Albe, one of the foremost of living British physicists, writing in the scientific magazine, *Nature*.

Dr. Fournier d'Albe's opinion is not the snap judgment of a person dogmatically prejudiced against such alleged phenomena and unwilling to examine the case before pronouncing his verdict. On the contrary, *Nature* states in an editorial remark, he has given much sympathetic but critical study to the subject of psychic phenomena, insisting only that the evidence pass the tests usually given to any other claims advanced for serious scientific attention.

And he states, at the end of a long investigation of all the available evidence, that there is no proof of the reality of ectoplasm, the hazy, gauzy stuff that is supposed to exude from the bodies of mediums to form spirit materializations. Neither is there any proof, he adds, of the reality of telekinesis, or the ability of certain mediums to raise and move objects at a distance, holding them suspended in mid-air at will.

Concerning the fraudulence of ectoplasm, the British scientist's opinion is emphatic. But the credulity of the believers in this sort of thing makes the fraud easy. Indeed, the habitues of the seances stoutly de-

(Just turn the page)

MEDICINE

Doctors Increasing

Some 19,662 doctors in the making were enrolled in the 80 accredited medical schools of the country at the end of the last fiscal year, according to a survey just completed by the American Medical Association.

Of these 964 or 4.9 per cent. were women, a slight gain over the proportion of medical femininity of the preceding year. The present figure shows the largest number of medical students since 1911. The ranks of embryo medics have been steadily increasing, declare the editors of the American Medical Association, since 1919 when medical education was completely reorganized and higher requirements established.

(Just turn the page)

Ectoplasm Called a Fraud

(Continued from page 253)

fend the persons who trick them.

"Practically all the well-known mediums have been detected in fraud at one time or other," he says. "But for every such exposure there is a ready excuse. The medium is in a state of trance or semi-consciousness, and the controlling spirits are of all kinds, even tricksters. . . . The supernatural element is introduced at every stage. Even when not deliberately mentioned, it is made to influence the investigator in the form of a demand for 'sympathetic' conditions."

Ectoplasm seems to be different stuff at different times. "On two occasions Dr. von Schrenck-Notzing was able to obtain samples of the substance, and subject it to analysis. The first sample was indistinguishable from human skin such as might be peeled off a human heel. The second sample closely resembled saliva in its microscopical character."

"Quite recently another case of materialization was investigated by E. J. Dingwall. He found the materializations resembling animal tissue. 'The appearance,' he says, 'suggests something analogous to lung tissue, and the smell of the substance, according to Dr. Worcester, resembled the smell of the entrails of a freshly killed animal.'"

Dr. Fournier d'Albe is of the opinion that in view of the often-exposed frauds, a further pursuit of the subject would be unprofitable. "It is impossible to admit the existence of any new facts," he concludes, "and even a tentative explanation of them is uncalled-for. Science might just as well concern itself with the anatomy and physiology of fairies."

Science News-Letter, October 15, 1927

Doctors Increasing

(Continued from page 253)

Records of 63 of the medical schools showed that only 36 per cent. of the costs were paid by students' fees. The remainder came from state appropriations and private endowments. Actual cost of the training of each individual student ran up to \$705 for the year, the statistics show, whereas \$245 was the average sum paid by each student. The rapidly increasing cost of training new physicians is one of the pressing problems of medicine, authorities in the field believe. One of its most important aspects, in the light of the large numbers of applicants flocking into the schools, is some provision for the properly qualified student regardless of whether he is rich or poor.

Science News-Letter, October 15, 1927

Building Model Airplanes

(Continued from page 253)

the frame which, when all sections are covered, is trimmed off about 1/16 inch from the frame and the protruding edge turned over and fastened with banana oil. As with the wing pull the paper especially taut lengthwise to accurately preserve the wing curve.

Assembling and Flying

To put the various parts of the model together, take the frame and make sure that the propellers are so placed that when the point is directed away from you the right hand propeller will have to turn to the right to push the wind back to you, and the left propeller must rotate left to push. The large wing is fastened between the openings of the rear X-brace with two thin long rubber bands, which are placed under each stick and the two loops opened above the stick, and the wing passed under these loops, which when carefully released onto the wing surface will hold it in place. The elevator is fastened in a similar manner about three inches from the point. Both of these surfaces should be placed with the point of highest curvature toward the nose of the model. The wings must now be lined up to be at right angles to the center line of the frame, and not twisted in regard to each other. It is assumed that the rubber motors were placed on the frame when the power plant was described in a previous article, therefore all is now together. It will be noticed that because of the formation of the elevator the front edge is higher than the rear edge, thus no elevating blocks are needed.

To balance the model glide it several times before launching it under power. Thrust it from you gently while holding it by the propellers on a line with your eyes and if it climbs or dives move the elevator back or front respectively to correct that tendency. In cases of extreme need for adjustment the wing may be similarly moved. When all is in perfect balance the model is ready for flight.

A large field, with no obstructions, is required. It should be at least half a mile square and beyond it should be clear country so that the model will have plenty of chance to go as far as it can without interruption. For the first flights a rather calm day is preferred. Allow an assistant to hold the propellers while you go to the nose of the model and attach the "S" hooks to your geared

winder. Stretch the rubbers at least twice their length and wind the rubbers about 200 turns of the winder, in the direction necessary to impart correct rotation to the propellers. As you wind the rubbers come in toward the nose so that when you finish you will be right at the nose hook and can attach the "S" hooks there. Now take the propellers one in each hand, sight along the model for a final assurance that all is correct for flight, stoop down and face the wind. Careful handling is very necessary throughout this stage of the preparations as the frame is under great strain from the rubber motors' pull and any unusual twisting may cause it to break. Therefore from this crouching position carefully rise and as you do so launch the model. Do not thrust it much, just give it a gentle placing on the air. The model should climb rapidly against the wind, then turn and fly with the wind. If it climbs or dives, correct it as for the glides. If it turns to one side move the wing slightly to one side and test again. When perfect flights are obtained carefully mark the position of the surfaces in order that the model may always be placed in the best condition.

It is hard to predict the flight possible with this model, but it can safely be said that if the model has been carefully constructed in accordance with this series of articles it should fly at least for a distance of 2,000 feet and a duration of a minute and half. It is well within possibility that those figures may be doubled or even tripled, depending on the workmanship and lightness of the model.

Science News-Letter, October 15, 1927

Certain kinds of blue cloth stamped "holy" are worn by wandering Moors of Africa, who believe it makes them immune to disease.

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First Glances at New Books

THE OLD TESTAMENT—An American Translation—Alexander R. Gordon, Theophile J. Meek, J. M. Powis Smith and Leroy Waterman—*University of Chicago Press* (\$7.50). This is a new book to the average Bible-reader for now he has the scriptures in his own tongue and can understand what he reads as well as if he understood the Hebrew text. The diction is dignified and devout yet thoroughly modern; unobscured by obsolete words and clarified by careful criticism. It is a frank as well as a faithful version. Where a passage remains unintelligible in spite of all study it is so stated. Where a reading can be conjectured the reasons for it are given. Where various versions differ the choice is explained. The oldest known Hebrew manuscript of the Old Testament dates from the ninth century A. D., and this is eleven centuries after the last of its books was written, so the wonder is that the corrupt passages are so few. Whether one reads the Bible for religious, literary or critical purposes he will want to get at the original meaning as correctly as he can. The type is clear and the page is easy to read because of the clear type and the arrangement into logical paragraphs with the poetical passages printed as verse.

Science News-Letter, October 15, 1927

THE LIFE OF THE WHITE ANT—Maurice Maeterlinck—*Dodd, Mead* (\$2.50). "The years," says the dramatist in his introduction, "teach every man that truth alone is marvelous." Notwithstanding this modest disclaimer the great Belgian has been inspired to some of his best embroidery of fancy by the complex civilization of the termites.

Science News-Letter, October 15, 1927

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTION, 1926—*Government Printing Office* (\$1.50). This newest yearbook of the Smithsonian contains a most entertaining and enlightening collection of papers on science. To mention a few: Dr. W. E. Safford describes "Our Heritage from the American Indian," Dr. Austin Clark writes on "Fragrant Butterflies," Dr. Vernon Bailey on "How Beavers Build Their Houses," and Dr. C. G. Abbot on "The Evolution of the Stars" and "Influences of Sun Rays on Plants and Animals."

Science News-Letter, October 15, 1927

THE NEW CENTURY DICTIONARY—Edited by H. G. Emery and K. G. Brewster—*Century* (\$22.50). The Century Dictionary in its original form of ten tall volumes has hitherto been the envied possession of large libraries and rich men. Now it is brought within the reach of many whose shelf space and book money are limited. The three volumes are light enough to hold in the hand and sufficiently full to satisfy most purposes. The type is clear and there are several pictures on nearly every page, illustrations that actually elucidate the meaning. Thousands of new words and usages, originating since the war, have been added. Business terms, geographical and biographical names are placed in appendices. The new Century combines convenience, competency and comprehensiveness.

Science News-Letter, October 15, 1927

THE HUMAN BODY AND ITS CARE—B. M. Davis—*Rand McNally*. An excellently written, compact textbook of human physiology and hygiene, designed for first or second-year college use. The author has succeeded admirably in selecting out the fundamental facts from the great mass of data that constitutes present-day physiology. The illustrations are similarly stripped down to diagrams, exceedingly simple yet telling their stories accurately.

Science News-Letter, October 15, 1927

THE STORY OF EVEREST—John Noel—*Little, Brown and Co.* (\$4). An account of the valiant and almost-successful assault on the world's greatest height, written with a soldierly simplicity and directness, with illustrations by the author—the "highest-up" photographs ever taken.

Science News-Letter, October 15, 1927

COMPTES RENDUS DE LA SEPTIEME CONFERENCE INTERNATIONALE DE LA CHIMIE—Union Internationale de la Chimie Pure et Appliquée—*Secrétariat Général, Jean Gérard, Paris*. Abstracts of papers and proceedings of the Seventh International Chemical Conference, held at Washington, September 13 to 15, 1926.

Science News-Letter, October 15, 1927

GETTING WELL AND STAYING WELL—John Potts—*C. V. Mosby*. Information that all tuberculosis patients and their families should know.

Science News-Letter, October 15, 1927

The Rocky Mountain blue jay is really a gray jay.

EVOLUTION

Clay-Modelling in Genesis

Quotation from CREATION—Edwin Tenny Brewster—Bobbs Merrill.

"And Javeh formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul."

All our versions unite to obscure the meaning of this simple-minded passage. The Hebrew verb, which we, for edification, render "formed," really means "to mould with the fingers like wet clay," as the Septuagint frankly renders it, using *plassein*, whence our "plastic." We really ought, therefore, to say: Javeh "pottered" man out of clay and blew the wind into his nose. But, of course, that would hardly do.

Science News-Letter, October 15, 1927

ENTOMOLOGY

Wanted: Large Cockroaches

Apartment dwellers in American cities will be interested to know at least one populous spot on the globe is afflicted with a dearth of cockroaches.

When the reptiles in the London Zoo were moved recently to new and sanitary quarters the large, mouse-sized American cockroaches that had made their home in the warm, dark, dirty lurking places around the furnace pipes were out of luck. In the process of making the old reptile house over into a home for small birds the dark places have been opened up, the warm pipes removed and the dirt cleared away with the consequent disappearance of suitable cockroach homes.

Their presence in their old abiding place was condoned by the keepers if not actually encouraged, not only because the insects furnished food for many of the lizards but because the keepers turned many an honest penny by selling them to biological laboratories for dissection. Now, however, there is a cockroach famine. Large juicy cockroaches of the American variety can be found in no other animal house in the Zoological Gardens, so the Zoo authorities have had recourse to breeding them in the insectarium where other insects and worms are bred to gratify the capricious appetites of the larger Zoo inhabitants. Whether a regular supply can be secured instead of merely a glut at the most favorable season and whether the cannibal instincts of their charges can be restrained in such close quarters are problems that will make life interesting for the guardians of the cockroach farm.

Science News-Letter, October 15, 1927

How to Use Key-Word Feature of News-Letter

In order to aid in catching the items that concern you and to facilitate clipping and filing, a key word in small capitals has been printed on the right of the line above each article. The key words used fit into any system of classification, whether it be a straight alphabetical file, a system of your own devising, the Library of Congress classification or the Dewey system.

Note that you can clip out any article without fear of damaging another article in which you might be interested, since editorial matter printed on the right-hand pages is backed by advertising, standing matter or a continuation of the article on the other side.

Library of Congress Classification

The classification of the Library of Congress has come into common use in the libraries of the country owing to the publication by the Government of the card index of all new books. We print below a list of the subject titles which are most used in the SCIENCE NEWS-LETTER. The full scheme of classification is contained in "Outline Scheme of Classes," issued by the Library of Congress.

| | |
|----|----------------------------------------------------------------------------|
| A | General Works. Polygraphy. |
| B | Philosophy. |
| BF | Psychology. |
| G | Geography, voyages, travel. |
| GA | Mathematical and astronomical geography. |
| GB | Physical geography. |
| GC | Oceanology and oceanography. |
| GF | Anthropogeography. |
| GN | Anthropology. Somatology. Ethnology. Ethnography. Prehistoric archaeology. |
| GR | Folklore. |
| GT | Manners and customs. |
| GV | Sports and amusements. Games. |
| HC | Economic history and conditions. National production. |
| HD | Economic history. Agriculture and Industries. |
| HE | Transportation and communication. |
| HF | Commerce. |
| HM | Sociology. General. |
| HQ | Family. Marriage. Woman. |
| HV | Social pathology. |
| L | Education. |
| M | Music. |
| N | Fine arts. |
| P | Philology and linguistics. |
| Q | Science. General. |
| QA | Mathematics. |
| QB | Astronomy. |
| QC | Physics. |
| QD | Chemistry. |
| QE | Geology. |
| OH | Natural history. |
| OK | Botany. |
| QL | Zoology. |
| QM | Human anatomy. |
| QP | Physiology. |
| QR | Bacteriology. |
| R | Medicine. General. |
| S | Agriculture. General. |

| | | | |
|----|---------------------------------------------------------------------------|-----|-----------------------------|
| SB | Field crops. Horticulture. Landscape gardening. Pests and plant diseases. | 450 | Italian |
| SD | Forestry. | 460 | Spanish |
| SF | Animal culture. Veterinary medicine. | 470 | Latin |
| SH | Fish culture and fisheries. | 480 | Greek |
| SK | Hunting. Game protection. | 490 | Minor Languages |
| T | Technology. General. | 500 | NATURAL SCIENCE— |
| TA | Engineering. General. | 510 | Mathematics |
| TC | Hydraulic engineering. | 520 | Astronomy |
| TD | Sanitary and municipal engineering. | 530 | Physics |
| TE | Roads and pavements. | 540 | Chemistry |
| TF | Railroads. | 550 | Geology |
| TG | Bridges and roofs. | 560 | Paleontology |
| TH | Building construction. | 570 | Biology |
| TJ | Mechanical engineering. | 580 | Botany |
| TK | Electrical engineering and industries. | 590 | Zoology |
| TL | Motor vehicles. Cycles. Aeronautics. | 600 | USEFUL ARTS— |
| TN | Mineral industries. Mining and Metallurgy. | 610 | Medicine |
| TP | Chemical technology. | 620 | Engineering |
| TR | Photography. | 630 | Agriculture |
| TS | Manufactures. | 640 | Domestic economy |
| TT | Trades. | 650 | Communication. Commerce |
| TX | Domestic science. | 660 | Chemical technology |
| U | Military science. General. | 670 | Manufactures |
| V | Naval science. General. | 680 | Mechanic trades |
| | | 690 | Building |
| | | 700 | FINE ARTS— |
| | | 710 | Landscape gardening |
| | | 720 | Architecture |
| | | 730 | Sculpture |
| | | 740 | Drawing. Decoration. Design |
| | | 750 | Painting |
| | | 760 | Engraving |
| | | 770 | Photography |
| | | 780 | Music |
| | | 790 | Amusement |
| | | 800 | LITERATURE— |
| | | 810 | American |
| | | 820 | English |
| | | 830 | German |
| | | 840 | French |
| | | 850 | Italian |
| | | 860 | Spanish |
| | | 870 | Latin |
| | | 880 | Greek |
| | | 890 | Minor languages |
| | | 900 | HISTORY— |
| | | 910 | Geography and travels |
| | | 920 | Biography |
| | | 930 | Ancient history |
| | | | Modern |
| | | 940 | Europe |
| | | 950 | Asia |
| | | 960 | Africa |
| | | 970 | North America |
| | | 980 | South America |
| | | 990 | Oceania and polar regions |

About Buying Books—

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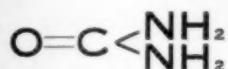
Classics of Science:

Synthesis of Urea



Wohler's experiments in organic chemistry were made into a text-book by Rudolf Fittig, himself an eminent discoverer in the field, and were translated by Ira Remsen for use in the colleges in America, at the time when organic chemistry was only beginning to be studied outside Germany. The quotation below gives full directions for preparing this interesting compound.

WOHLER'S OUTLINES OF ORGANIC CHEMISTRY, by Rudolph Fittig, Tr. from 8th German Edition by Ira Remsen, Philadelphia, 1873.



Organic Compounds

Organic Chemistry is the chemistry of the compounds of carbon. It includes those compounds of carbon which have had their origin in the organs of plants and animals, as well as those which have been produced exterior to the living organism. . . .

The processes, more intimately connected with the formation of the primitive organic compounds in the living organism of plants and animals, are almost entirely unknown to us. We only know with certainty that all organic material is originally formed in plants, that for this purpose plants make use of the elements of existing compounds particularly of carbonic acid, water, ammonia, and the inorganic acids of nitrogen, and that this process of formation takes place only under the influence of sunlight and of certain inorganic salts, which are absorbed from the soil; the manner in which this takes place is, however, up to the present, inexplicable. The animal organism, on the other hand, receives its constituents in the food in the form of organic compounds already existing.

A great many of the organic compounds occurring in nature can be produced artificially from the elements, but in by far the most cases, the conditions and the chemical processes are entirely different from those through the instrumentality of which the formation occurs in nature.

The Artificial Product

For the artificial preparation of urea, crude potassium cyanate is prepared as follows:

A mixture of 8 parts of previously dehydrated iron ferrocyanate and 3 parts of potassium carbonate is heated to fusing, and 15 parts of red lead added gradually to the somewhat cooled, but still liquid mass. After the reduced lead has been separated, the salt-mass is poured off, and the potassium cyanate extracted by means of alcohol.—Lamellae, similar to potassium chloride; easily soluble in water, yielding potassium carbonate and ammonia.

The crude potassium cyanate is dissolved in water without the aid of heat, and to the solution as much ammonium sulphate is added as potassium ferrocyanide was employed; the liquid is evaporated down to a small volume, the potassium sulphate, that crystallizes out on cooling, filtered off, and the filtrate evaporated to dryness. The urea is extracted from the residue by means of alcohol.

The Natural Product

Extraction of urine: Urine is evaporated to syrupy consistence, and, when cool, mixed with an excess of strong nitric acid. Urea nitrate separates in the form of dark brown crystalline masses. It is now filtered off, pressed, and purified by recrystallization from moderately strong nitric acid. It is most easily obtained colorless, but not without loss, by gradually adding small quantities of finely powdered potassium chlorate to the hot concentrated solution in nitric acid, then allowing to cool and recrystallizing the almost colorless crystals which now separate, either from water or nitric acid. The urea nitrate, purified in this manner, is now decomposed by heating with water and barium carbonate, the filtrate evaporated to dryness and the urea extracted from barium nitrate by means of cold alcohol. It crystallizes from the solution, when concen-

tated by distilling off a portion of the alcohol.

Properties of Urea

Properties: Colorless, four-sided prisms, without odor, of a cooling taste; fuses at 130°. Easily soluble in water and alcohol.

Heated above its fusing point, it is decomposed, ammonia is given off, and, according to the duration of the heating, the residue consists either of biuret or cyanuric acid.—By heating with water in fused tubes above 100°; by boiling with alkalies; by heating with concentrated sulphuric acid; by evaporation of the solution, to which is added lead acetate, urea is resolved into carbonic anhydride and ammonia, water being assimilated. When heated for some time with alcoholic carbon bisulphide, ammonium sulphocyanate and carbonic anhydride are formed.

Urea combines with bases, acids, and salts, forming crystallizing compounds.

Friedrich Wöhler was a life-long friend of Liebig, and performed most of his researches in organic chemistry with him, at other times turning his energies toward extraction of the rarer metals, including aluminum, in the pure state. The synthesis of urea, for which he is most famous, was the first preparation in the laboratory of a product of the living organism, and was the work of Wöhler alone. Wöhler was born July 31, 1800, near Frankfort-am-Main, Germany, and died September 23, 1882, at the University of Göttingen, where he had taught for 46 years. The synthesis of urea was accomplished when Wöhler was 28 years of age.

Science News-Letter, October 15, 1927

ICHTHYOLOGY Mosquito Fish in Italy

Gambusia, the little fish that befriends man by devouring mosquito "wrigglers," is finding things even more to his liking in the ponds and ditches of Italy than in his native American home, according to reports received here from Rome. Carried first to Spain and thence to Italy to combat the malarial mosquitoes, this hungry little minnow has multiplied enormously throughout the region around the mouth of the Tiber, where it was first introduced, and has also been transplanted into shallow waters throughout the peninsula and along the Dalmatian coast. More favorable food and other environmental conditions, and probably the absence of natural enemies that take toll of its numbers in America, are credited with the gratifyingly abnormal rate of increase.

Science News-Letter, October 15, 1927

The Finest Culture of the Age —

EVERYWHERE we turn, we find the background of fundamental science. It surrounds our most intimate lives. On it health and hygiene is based. It enters our homes. Nutrition and diet, foods and food-handling are governed by it.

The great questions of the day, social and moral; marriage and divorce, "better babies," our social institutions, statecraft and politics—in all we are seeking and finding the scientific fundamentals.

Our understanding of the great world of nature has increased manifold. Our ideas and concepts are infinitely more exact.

Books of science today are much more than works of reference, much more than merely to give information on specific points. They represent the highest culture in this Age of Science. None can claim a well-rounded culture without some understanding of scientific background. None can pretend even to a glimmering of what the modern world is about, unless he can share the calm dispassionate view of the scientist.

In an adjoining column a handful of books are suggested. They are books to read for the sake of good reading, for general culture of the mind and understanding. They require no technical training. They are representative of the best in modern culture.

Their presence on your library table marks you as one who knows the modern world, who endeavors to keep abreast of the advanced thought of our day.

Cultural Books on Many Subjects

The Backs of Books—*Bishop* \$4.00

A friendly book on the science of books, for booklovers. A pretty gift for a friend who is a librarian.

Five Years in Turkey—*von Sanders* \$3.50

The story of the Gallipoli and Palestine campaigns in the Great War from the German side. Important for a full understanding of stirring events.

Light and Health—*Luckiesh and Pacini* \$5.00

A narrative account for the general reader of the importance of light to hygiene and general welfare. A subject of many fascinating ramifications.

Social Psychology—*Dunlap* \$3.00

Gives a better understanding of what forces are at work in moulding the social order—and why we behave as we do. No use talking about "mob psychology" unless you know what it is.

Man and His Affairs—*Polakov* \$2.50

Einstein's theory is far-reaching. This book tells how mathematical thinking can alter the social code and *mores*. A book you will read at least twice. Distinctly modern.

Problems in Human Reproduction—*Popenoe* \$2.50

We hear a lot about eugenics and race improvement. This gives the scientific background in non-technical language. Tells what can and what cannot be expected from the eugenics movement.

Conservation of the Family—*Popenoe* \$3.00

The biological reason why for the oldest of our social institutions. A sane and orderly discussion in sane and ordinary terms.

Fundamental Concepts of Physics—*Heyl* \$2.00

The present century has produced a world of new ideas about the structure of matter, the universe and all that therein is. Here is a philosophical summary of the advances of the last three centuries.

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